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a new species of Caprellidæ, *Metaprotella sandalensis*, by Dr. P. Mayer, and notes on a little known sea-snake by G. A. Boulenger.

Part II. contains a description of the coral-like *Millepores* by S. J. Hickson. All the specimens are referred to one species, *M. alci-cornis*. Material for the study of the soft parts of these delicate organisms was collected. Some of this was found to be infected by what seemed to be a species of *Bacterium*, and which Hickson has named *B. milleporæ*. The netting capsules were studied in detail, and in some the 'thread' had the form of a delicate tube, in the center of which was a filament. This is probably contractile and brings about the remarkable retraction of the 'threads,' as observed by Dr. Willey in the living animal.

Of the crinoids, sea urchins, star fishes and brittle stars thirty-nine species are reported by F. Jeffrey Bell, almost all of which were well-known forms. Of the twenty-four species of sea-cucumbers collected, F. P. Bedford reported two new to science.

None of the twenty-three species of Sipunculi obtained were new, a fact accounted for by Shipley from the circumstance that the two largest collections of these worms ever made, namely, those of Semper and of Sluiter, were made in the same general region as that in which Dr. Willey worked. While such an outcome may be disappointing to those who are ambitious for the description of new species, it is reassuring in that it shows that a piece of zoological work once well done need not be repeated.

Fourteen species of solitary corals are recorded by J. S. Gardiner, and of these no less than eleven are new. Gardiner also contributes a paper on the post-embryonic development of one of these, *Cycloseris*, in which the close affinity of this genus with *Fungia* is emphasized. Of the thirteen species of fleshy corals of the family gorgonaceæ reported by I. L. Hiles five are new.

The earthworms were studied by F. E. Bedford. Some were too immature for certain identification, but among the well-developed specimens nine species were recognized, three of which were new.

The second part is fully equal to the first and

is especially noteworthy for the success with which photography has been used in its illustrations. The photogravure plate accompanying Gardiner's paper on *Cycloseris* is remarkable for the sharpness of its detail; the naturalness of the figures exceeds that found in the best hand lithography. The photographic prints which illustrate Hickson's paper on the *Millepores* give an idea of the nature of the material collected, which in the case of these extremely variable animals could be obtained by no other method. The authors and publishers alike are to be congratulated on their successful use of photography.

So far as the present work is concerned, such criticism as may be offered touches rather the whole undertaking than any particular part thus far completed. While it may be gratifying to an explorer to see the results of his collecting and personal investigation in the form of a compact whole, it is not always certain that this is the best way in which to make it accessible. Such publications are dependent largely on subscription for their circulation and necessarily fall much behind the better class of scientific journals. Since, as in the present case, they contain the first descriptions of many new species, their relative inaccessibility is often a serious obstacle to succeeding investigators. It is to be regretted that all the present series of contributions could not have found places in some of the current zoological journals, as, in fact, some have, thus, in a measure, assuring the accessibility of their contents.

G. H. P.

Traité élémentaire de mécanique chimique, fondée sur la thermodynamique. By P. DUHEM. Vol. III.; 18x25 cm.; pp. 374. Vol. IV.; 18x25 cm.; pp. 381. Paris, A. Hermann. 1898 and 1899.

Vol. III. treats of homogeneous mixtures and solutions with only one volatile component. The opening chapter deals with the thermodynamic potential of a homogeneous mixture. This is followed by one on the state of dissolved substances and by another on dilute solutions. Next in order comes osmotic pressure, and then we find chapters on the hypotheses of Van't Hoff and of Arrhenius, and on the mass law.

The second half of this volume is given up to a discussion of equilibrium in systems containing one solution phase and at least one solid phase.

Volume IV. is devoted to what Duhem calls 'double mixtures' and to general equilibrium in heterogeneous systems. By 'double mixtures' Duhem means two component systems containing at least two phases of variable composition. Under this head come fractional distillation, critical states of mixtures, liquefaction of mixed gases and systems containing two liquid phases. A great deal of space is devoted to a consideration of the alleged law that the vapor-pressure of a dineric system is the same as that of the more volatile component. The volume closes with a general discussion of the phase rule, in the course of which it is pointed out that the classification followed throughout the four volumes has been based on the phase rule and that all good classifications must be so based. This is very satisfactory, but it would have been more satisfactory if we had been told this at the beginning of the first volume instead of at the end of the fourth. One great fault in all of Duhem's writings is his refusal to tell the reader what is to be proved. The result is that the reasons for the single steps do not become clear until the second reading. From the Baconian point of view it is very pretty to marshal the facts in a splendid array and then to point out the general law of which they are special illustrations, but Bacon is not famous as a successful writer of text-books. It would have been very much simpler to have deduced the phase rule and then to have pointed out the way in which it should be applied. As far as the qualitative equilibria are concerned, this is also the historical method. Gibbs deduced the phase rule as a general theorem, and Roozeboom has, since then, shown its value as a guide.

These four volumes of Duhem's constitute a monumental work and will be of immense service. On the other hand, it would easily be possible to overestimate their value. What we have is an exhaustive study of chemical equilibrium put into mathematical form and expressed in terms of the thermodynamic potential. This application of mathematics to chemistry is unfortunately more ornamental than useful. There

are myriads of formulas, but very few can be applied to any concrete case. The book is really only a mathematical outline in which formulas are indicated. The equations contain unknown functions. To the experimental theorist the book is a joy and a sorrow, a joy because it points out so much and a sorrow because it always stops short of becoming practical. One of the most striking features about Helmholtz was the fact that he cast his theoretical speculations into such a form that they could be tested quantitatively. Duhem has never done this in physical chemistry. He has done brilliant work, but his theory has always been qualitative and not quantitative theory. If anyone doubts this he has only to read the four volumes of the *Mécanique chimique* and he will be convinced.

WILDER D. BANCROFT.

Le céramique ancienne et moderne. Par E. GUIGNET et EDOUARD GARNIER. Paris, Felix Alcan, 108 Boulevard Saint-Germain. 1899. 8vo. 69 figs. Pp. 311.

This volume is No. 90 of the series 'Bibliothèque Scientifique Internationale,' edited by M. Em. Alglave. Its authorship is in collaboration by MM. E. Guignet and Edouard Garnier. The work consists of two grand divisions, the first, by the Director of the Dyeing and Coloring Department of the Gobelin and Beauvais Tapestry Manufactories, relates to the fabrication of ceramics; the second, by the Conservateur of the Museum of the Pottery and Porcelain Manufactories at Sevres, is on the history of Ceramics.

The first part deals with the material of which pottery and porcelain is made, describes it at length, shows the differences between the different products, gives by analysis the component parts of the various materials required for these products, and describes their mode of treatment and preparation for use. It presents by elaborate definitions the different kinds of ceramics, and shows principally by chapters, the differences between pottery, faience and porcelain. It represents by description and diagram the machinery used in the treatment of the material, in the fabrication and forming of the objects, and the ovens in which they are baked.